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This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations by the Du Pont Company. It also contains published reports of investigators at agricultural experiment stations and other institutions as related to the Company's products and other subjects of agricultural interest.

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> "Our progress up to now has been in direct ratio to the degree of human freedom afforded us. Our rate of progress in the future will be determined in identical fashion. I am quite confident that this essential truth will be recognized and affirmed by the American people." -- C. H. Greenewalt, speaking at 150th anniversary celebration.

FREEDOM IS KEY TO PROGRESS IN AMERICA, DU PONT PRESIDENT SAID AT CELEBRATION

The "vast unexplored area of science" opened up by advancing technology is a "new continent" fully as rich and as abundant as the geographical America of 150 years ago, Crawford H. Greenewalt, president of the Du Pont Company, said at ceremonies marking the 150th anniversary of the company. This area, he said, is "full of promise for the future."

"The possibilities in increased productivity alone" from this world of science "are enough to expand our standard of living substantially beyond its present high level," he predicted in a talk made at the site of the first Du Pont mill and broadcast to Du Pont employees in plants throughout the country as well as to a nationwide radio audience.

Possibilities for Improvement are Unlimited

Mr. Greenewalt declared the possibilities "are of a scale and a diversity far beyond the comprehension" of anyone in his audience. Nearly 7,000 people were gathered in the natural amphitheater at the site of the first Du Pont mill on Brandywine Creek, in the outskirts of Wilmington, for the celebration on July 18.

Henry B. du Pont, great-great-grandson of Eleuthere Irenee du Pont, founder of the company, and a vice-president and member of the Du Pont executive committee, traced the influence on the company of some of the earlier members of

the du Pont family. Walter S. Carpenter, Jr., chairman of the board, and a former president of the company, dedicated a marker formed by one of two huge millstones ordered from France by the company's founder.

Mr. Greenewalt said that Eleuthere Irenee du Pont came to the United States from France to find freedom, and that here he had been free to build his enterprise on his own initiative, free "to undertake the risks, carry the burdens, and reap the rewards."

Immigrants Came to Enjoy Individual Liberty

"Many others had the same encouragement and the same will to achievement," he said. "And so did their children and their children's children through many generations, bringing to us of the present day the cumulative accomplishments under freedom's banner."

Yet today, Mr. Greenewalt said, "freedom has been mortgaged -- bit by bit -- on the plea of crisis or emergency. Rights of minorities in the economic area have been disregarded, to the point where the virtues of thrift, enterprise and initiative have lost much of their original glamour."

To meet the challenges of the great new world of science, he said, "we must face them as the men and women of Irenee du Pont's time faced theirs -- with the same venturesome spirit, the same zeal, the same determination. And it follows that we should and must have the same conditions that nurtured this spirit -- the same freedom, the same incentive, the same spur to initiative.

"Our progress up to now has been in direct ratio to the degree of human freedom afforded us. Our rate of progress in the future will be determined in identical fashion. I am quite confident that this essential truth will be recognized and affirmed by the American people.

No Limit to Progress if Liberty Assured

"With freedom assured, there can be no limit to the progress we can make. The new continent we have before us has no boundaries. Its horizons are as broad and as limitless as the spirit and the imagination. For us it is the opportunity of multiplying our national inheritance many times. I am sure we can do so."

To speculate on what the world of science has in store, Mr. Greenewalt said, "is to indulge in an academic exercise of little consequence. The possibilities in increased productivity alone are enough to expand our standard of living substantially beyond its present high level. But what vast new panoramas will open before us, no one can say. I know they are there, just beyond the horizon, and that they are of a scale and a diversity far beyond the comprehension of anyone here today."

The marker dedicated by Mr. Carpenter is a seven-ton millstone resting on a granite base on which have been mounted bronze plaques designed and executed by Domenico Mortellito, Wilmington sculptor.

People Constitute Du Pont's Greatest Asset

Mr. Carpenter said that the stone "will commemorate, not only today but for many years to come, the services of those thousands of men and women who have preceded us; who are here today; and who will, in turn, succeed us. And to that end there has been inscribed upon this monument the following: 'On this site in 1802 the Du Pont Company was conceived. It has grown with the growing nation under a system dedicated to freedom. Its greatest asset has been all its people and its guiding philosophy that there is no privilege that is not inseparably bound to a duty.'"

"Just as this very wheel served many years ago to mix the three ingredients required to make the company's first product," Mr. Carpenter continued, "so now it symbolizes the three components which were essential to the success of this entire enterprise; namely, work, tools and leadership. Each of these components expresses the contribution of the people who participated in this venture. The work was performed by people at all levels in the organization. The tools were supplied for use and risk in this enterprise through the savings of many people. The leadership was furnished by the intelligence, courage and initiative of people dedicated to a common cause. No one of these three stands alone; each merges with the other until they become a whole, intimate and inseparable.

"The men and women of whom we speak originally constituted but a small group, for the initial plant required but a few operators. They walked to their work in this mill from their homes nearby. As the mill grew in size, the group enlarged; and as the company grew and prospered over the years, new plants were built and more men and women from all parts of the country joined the ranks of the company. They rendered their service to the joint effort through good times and bad, often in times of danger and hardship, over a century and a half. Without their help this endeavor could not have succeeded."

Ten Presidents Guided Company in 150 Years

Henry B. du Pont, speaking of some of the men and women who contributed to the company's growth and success, observed that of the company's ten presidents since 1802, four were present at the anniversary ceremonies: Pierre S. du Pont, Irenee du Pont, Mr. Carpenter, and Mr. Greenewalt. Of the founder, he said in part:

"I like to think of E. I. du Pont de Nemours," Henry du Pont continued, "as typifying those business pioneers who built up the country in its early days. Like most, he started at rock bottom level. He came to Delaware with little means, but with strong determination to develop a business that would fill a national need. He borrowed the money to build his first mills, and throughout his lifetime he was seldom free of debt. Yet he had qualities of courage and perseverance which sustained him through all kinds of troubles and disasters.

"I like to reflect, too, upon the help and encouragement given him by his wife, who was certainly the first Du Pont employee of her sex. There is a touching letter written by E. I. du Pont while he was away from home on a business trip in which he instructs her carefully about running the yards in his absence.

I recall that it warns her not to have powder glazed when it was too damp, and if she needed to make more deliveries, to borrow additional horses from the neighbors!"

DU PONT NOW PRODUCING NEW NON-TOXIC FUNGICIDE PAINT

Du Pont is trial marketing a new mildew-resisting enamel containing a non-toxic fungicide for use in food processing areas where mildew control is a serious problem. It employs "Cunilate" fungicide as recommended by research groups of the meat packing industry as well as Army laboratories at Fort Belvoir, Va., and is called Du Pont Mildew Resisting Packinghouse Enamel.

Tests in creameries, meat packing plants, branch houses, and poultry plants show this formulation to be highly effective. Panels exposed over 18 months were mildew-free in rooms where ordinary paint is covered with a profuse mold growth within two months.

Published reports of successful experimental use of this fungicidal finish emphasize that its cost is negligible compared to present cleaning and scrubbing requirements. In such areas a standard paint film rapidly succumbs to fungus attack and from the almost constant cleaning.

Finish Extensively Tested for Toxicity

"Cunilate" fungicide, or copper-8-quinolinolate, is manufactured by the Scientific Oil Compounding Company, Chicago. According to the U. S. Surgeon General and the Bureau of Animal Husbandry as well as the Du Pont Haskell Laboratory of Industrial Toxicology, "Cunilate" fungicide is non-toxic. It is rated as the most effective safe fungicide yet evaluated for paint.

Du Pont technical personnel who successfully formulated the new mildew resisting enamel say that in order to achieve a satisfactorily balanced finish it is necessary to incorporate the fungicide in the course of manufacture.

Although technically being introduced on a trial basis, Du Pont feels sufficient test experience is behind it to warrant starting production. The Finishes Division, which has worked in association with Armour's research program, foresees need for Mildew Resisting Enamel not only in packing houses, meat and other food processing industries including breweries, bakeries, dairies but also possibly in textile plants.

DU PONT TODAY

The Du Pont Company today is hundreds of thousands of people. Its employees, who numbered a few score when the company was founded 150 years ago, now comprise 87,000 men and women; its shareholders have grown from six to more than 140,000; its customers now exceed 75,000 and its suppliers 30,000, most of them small concerns.

Once the manufacturer of a single item, black powder, Du Pont now makes some 1,200 different products and product lines in 71 plants in communities scattered through 25 states. Almost a third of the company's sales go to the textile industry. Although the country's largest chemical manufacturer, Du Pont has only eight per cent of the chemicals and allied products business. Du Pont has more than 10,000 competitors and competes with from one to fifteen major producers in virtually all of the product lines that make up most of its business.

The company's operating investment, which is about $1½ billion, represents an investment of around $18,000 for each employee. Employee benefits, which annually total more than $60 million, include pensions, vacations with pay, aid in time of illness, hospitalization costs, and life insurance. As the result of a highly organized safety program, employees are safer at work than they are at home.

Five thousand of the company's employees, technical and non-technical, staff its 38 research and development laboratories from which new products, new processes and new developments are being constantly brought forth. Within recent years about half of Du Pont's sales have been in products that were unknown, or in their commercial infancy, 20 years previously.

DU PONT--A SHORT HISTORY

Eleuthere Irenee du Pont de Nemours arrived on the banks of the Brandywine on July 19, 1802, to build a mill for production of black powder, urgently needed by the young nation for hunting, land clearance, mining, quarrying, and self-protection. The company has grown to be the country's largest producer of diversified chemicals and chemical products.

The Du Pont Company's growth has been continuous, and has resulted largely from research directed toward higher quality, lower prices, and new products to meet the nation's expanding needs. As early as 1804, the year in which the first finished powder from Du Pont mills was sent for sale to New York, a patent was issued to E. I. du Pont de Nemours. This covered a machine for granulating gunpowder.

Until 1832 Du Pont made black powder only. In that year, the company added to its line refined saltpeter, refined charcoal, an acid made from wood, and creosote. In 1857 came an improved blasting powder invented by Lammot du Pont, the founder's grandson. In 1880 the company began to make two high

explosives, nitroglycerin and dynamite. These products helped to hasten the westward extension of the frontiers and industrial growth of the nation.

Nitrocellulose Leads to Diversification

When Pierre S. du Pont, a son of Lammot, joined the company in 1890, one of his first tasks was research on another new explosive, smokeless powder, based on nitrocellulose. This step took the company into the field of cellulose chemistry, the foundation of many of its later developments.

All Du Pont research originally was carried out in plant laboratories or in the homes of members of the du Pont family. Then, in 1902, the company built the Eastern Laboratory at Gibbstown, N. J., its first formal research venture.

The Experimental Station, which now embraces the company's largest research facilities, was established the following year, 1903, on the Brandywine near the site of the original mills. Its purpose was the expansion of the company's business beyond the traditional lines of explosives into the newly unfolding panorama of modern chemistry.

The first noteworthy departure from explosives came in 1904 when Du Pont began producing a special type of nitrocellulose for lacquers and other industrial uses. Subsequent steps in the pattern of diversification followed when nitrocellulose-coated fabrics, then known as "artificial leather", were added in 1910, and pyroxylin or nitrocellulose plastics, in 1915.

Activities Embrace Variety of New Fields

The company entered the paint field in 1917, and six years later introduced "Duco" pyroxylin lacquers, which were to revolutionize the finishing of automobiles and furniture. In 1917 Du Pont built its first unit for production of dyes, a venture that was to involve the expenditure of $43 million before earnings offset accumulated losses, but which was to help free the United States from dependence upon German coal-tar dyes.

Production of two other cellulose products started in the 1920's-- rayon, first of the man-made fibers, in 1920, and cellophane in 1924. Du Pont's development of moistureproof cellophane in 1927 had a sweeping effect on packaging, particularly in the food field.

Another outstanding development of the period was the construction of a plant for the high-pressure synthesis of ammonia. This led to development of new processes for manufacturing methanol, glycol, urea, higher alcohols, and other basic chemicals of great industrial importance.

Fundamental Research Program Started

In 1927 Du Pont launched its program of fundamental research -- that is, research to uncover basic facts, without regard for specific commercial objectives. It is since that date that the company has experienced its greatest growth. Among the outstanding results of this program are neoprene, the first successful general

purpose synthetic rubber, announced in 1931, and nylon, the first truly synthetic fiber, announced in 1938.

The company swiftly became a factor in such other phases of the chemical industry as plastics, electrochemicals, heavy chemicals, photographic film, agricultural chemicals, organic chemicals, and pigments. Among recent Du Pont developments are the newer synthetic fibers, "Orlon" acrylic fiber and "Dacron" polyester fiber; "Teflon" tetrafluoroethylene resin, an industrial plastic which withstands acids and retains its form and strength at temperatures higher than any other known organic material; "Mylar" polyester film, a clear, transparent film which is expected to find many electrical and industrial uses for which other man-made films are inadequate; methoxychlor, an insecticide with very low toxicity to warm blooded animals; polythene, a plastic which is a good electrical insulator and is tough and flexible over a wide range of temperatures; and "Erifon" durable flame retardant for cotton and rayon fabrics.

Du Pont powder was first used by American military forces in naval fighting against the Algerian pirates in 1805. Since then, Du Pont powder has been used in every war in which the United States has been involved. The company supplied 1½ billion pounds of military explosives to the Allies in World War I, and 4½ billion pounds in World War II. In addition, in World War II Du Pont designed, built and operated the Hanford atomic energy plant for the Government for a fee of $1. Today the company is building and will operate the Savannah River Works for the Atomic Energy Commission, also for a fee of $1.

Chemical Industry Wants Peaceful Society

While the company's World War II activities brought a large increase in physical volume of output, earnings per share of common stock during the war years declined 21 per cent below the 1939-1941 average. Walter S. Carpenter, Jr., then president of the company, commented at the end of the war: "It should be plain that the business interests of the company lie, primarily and overwhelmingly, with peace. However essential to modern warfare the chemical industry may be, its prosperity and prospects can be realized only in a peaceful, orderly society."

Since the end of World War II, Du Pont has spent more than $650 million to build new plants and improve existing ones. It has spent about $40 million to provide up-to-date and enlarged research facilities. Last year, research expenditures, aside from construction costs for new facilities, were $47 million.

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SIMPLIFIED VAT-SIDE TEST INSTRUCTIONS AVAILABLE

Few things are more useless than dipping cattle in a vat in which the insecticide strength has become too weak after being in use awhile. The strength may go down because of rain, or simply because a lot of cattle have gone through the vat.

If, on the other hand, evaporation of water leads to an unduly high concentration of insecticide, then there is danger of harming the animals.

Knowing that the dip concentration continues at the proper level thus becomes of importance to livestock raisers. No chemist is needed at the vat-side to determine concentration of the dip at a given moment. Dr. J. B. Leibee, a Wilmington chemist, has assembled a kit in convenient form for stockmen who use Du Pont Livestock Spray and Dip No. 30 to do their own testing. It was described in the September-October, 1951, issue of the Agricultural News Letter.

Dr. Leibee has written a new set of directions, and added 12 photographs of the principal steps involved, to make it easier for any livestock raiser to run the test on his own vat. Copies of the new directions as well as information about the test kits may be obtained by writing him at his laboratory at 26 North Avenue, Boxwood, Wilmington, Delaware.

SINGLE FUNGICIDE CONTROLS ALL COMMON TOMATO DISEASES

"Manzate" fungicide controlled all the prevailing diseases of tomatoes in tests conducted in 1949, 1950, and 1951 at the Agricultural Experiment Station at Wooster, Ohio. Furthermore, in most cases it performed as well as, or better than, the fungicides with which it was compared for the control of each individual disease. These results were described by Dr. J. D. Wilson in the May-June, 1952, issue of *Ohio Farm and Home Research.*

Fungous diseases annually take a heavy toll of tomatoes. Until recently, complete control could not be obtained unless at least two different fungicides were used. Now, Mr. Wilson said:

"'Manzate' fungicide gives promise of being the nearest approach yet found to a fungicide that can be used singly to check those diseases for which the tomato is sprayed."

Results of Ten Comparative Tests

A summary of the 10 tests conducted in three years at the Ohio Station is given by Mr. Wilson as follows:

Early blight -- "'Manzate' should give as good control as ziram, zineb, or the fixed coppers."

Late blight -- As good as zineb. Better than ziram. "May be expected to fall somewhat short in some instances of the control given by some of the fixed coppers."

Anthracnose -- Equal of ziram. Somewhat superior to zineb. "Definitely more effective than the fixed coppers."

Early and late blight on foliage -- "'Manzate' may be expected to give good control."

Septoria and Stemphilium -- Comparison with other fungicides was not established in the Ohio tests because "these two diseases have not consistently been a part of the disease complex."

Conditions During Experiments

In 1949, the Ohio article said that early blight and anthracnose were comparatively severe in one of the tests. "Manzate" fungicide "gave better control of anthracnose than either ziram or zineb. Plots treated with 'Manzate' also produced fewer cull fruits and gave a higher yield of usable tomatoes than those treated with ziram or zineb. In another experiment, a half-and-half mixture of 'Manzate' and 'Parzate' fungicide gave slightly better disease control than did 'Parzate' used alone."

In 1950, late blight was severe at the Wooster experimental plots. Four different experiments were made, testing "Manzate" and other dithiocarbamate and copper-containing compounds. In one test, where "Manzate" saved 90% of the tomatoes, only 13% survived in the untreated check plots. Dr. Wilson described it as follows:

"In one instance in which late blight destroyed 87 per cent of the fruits in the untreated check plots, the loss was reduced to 10 per cent by 'Manzate', to 12 per cent by 'Parzate' fungicide (zineb) and to 56 per cent by 'Zerlate' fungicide (ziram). 'Tribasic' (a fixed copper) reduced the loss from fruit infection to only 4 per cent. Anthracnose, which was scarce in the experiment, was best controlled by 'Manzate'."

Additional 1950 Tests

Successive tests, in which the late blight was less severe, included the following results in 1950:

In a plot where 60 per cent of the untreated tomatoes were infected, "Manzate" was better "than either 'Parzate' or 'Tribasic'."

In a plot where 35 per cent of the untreated tomatoes were lost, "'Manzate' gave better control of the disease than 'Parzate' and did approximately as well as 'Tribasic'." On the foliage, "Manzate" was the best of all. For anthracnose on the fruits, "Manzate" also was the best.

1951 Conditions Described

During experiments conducted in 1951 there was no late blight, and only small losses were caused by early blight. "Manzate" fungicide "gave better control of the defoliation due to early blight than did zineb in three experiments and was tied with zineb in the fourth test. The plots treated with 'Manzate' showed less defoliation than did those treated with a fixed copper in each of the four experiments."

For the control of anthracnose in1951, "Manzate" was better than ziram in two trials, and ziram was only a little better than "Manzate" in the third.

"The yields of good fruits were slightly larger with 'Manzate' than with 'Parzate' in three of the four experiments," the Ohio publication added.

Twenty Years of Research on Tomatoes

The Experiment Station at Wooster has been engaged in research on tomato diseases ever since 1930, when it was discovered that Bordeaux mixture, until then exclusively used, could contribute to the death of the plants under drought conditions.

From 1930 to 1940 the "fixed" or "insoluble" coppers were popular, and then the organic dithiocarbamates appeared.

SEED TREATMENT OF SOUTHERN FORAGE CROPS PRODUCES MORE FEED PER ACRE

More feed per acre from the same quantity of seed was obtained in 1952 by 25 farmers in six southern states who cooperated in an experiment when they seeded their forage crop land last fall.

Part of the fall-seeded acreage on each of these farms was planted with high-quality seed of the grass or legume crop desired. The other portion was planted with the same seed, out of the same bag, but treated with a chemical fungicide to protect each seed and seedling against soil-borne disease organisms.

The tests were made in cooperation with representatives of the Grasselli Chemicals Department of the Du Pont Company. The chemical applied to the seed was an organic sulfur compound known as "Arasan" seed disinfectant. Tests were carried on in Oklahoma, Texas, Alabama, Georgia, Tennessee, and North Carolina.

Nine Types of Forage Crops Tested

Nine types of forage crops were involved in these tests. County agents and soil conservation workers watched the planting and observed the results in many cases. Fields were seeded under normal conditions by the farm operators, using their own equipment. When plants were well established in the spring, counts were made of the number of plants in areas where treated seed was planted, as compared with similar counts in untreated areas of the same field.

At Vinta, Oklahoma, a field was seeded to Ladino clover, one of the most expensive forage crop seeds on the market. Where treated seed was sown, 227% more plants developed than in an equal area of the same field where untreated seed from the same source was planted. At Hartwell, Georgia, in a field of Sericea lespedeza, 164% more plants developed as a result of seed treatment.

A list of crops involved and average stand increases follows:

Crop	No. Tests	Avg. Increase
Alfalfa	3	60%
Crimson Clover	3	49%
Sweet Clover	2	48%
Sericea Lespedeza	2	130%
Ladino Clover	1	227%
Vetch	3	33%
Ky. 31 Fescue	9	39%
Rescue Grass	1	23%
Grass Mixture	1	17%

Earlier Tests Made in North and West

These results were even more striking than in a previous series of 72 tests conducted in 1951 in 19 northern and far western states by Du Pont investigators. These earlier tests reflected the advantages of seed treatment in

spring-seeded crops and showed healthy increases for all crops tested. The southern tests were staged to evaluate this practice under the fall seeding program ordinarily followed by growers in this area.

This new practice is possible because "Arasan" seed disinfectant does not injure tiny grass and legume seeds, as would the mercury compounds used in treating grain. The chemical coating on the seed serves as a protective cloak to ward off attacks on the plant embryo by such fungous diseases as seed rot, seedling blight, and damping off. The chemical is toxic to these disease organisms, yet harmless to the seed itself.

ENTOMOLOGIST DEVELOPS QUICK WAY TO COUNT INSECT-DAMAGED WHEAT KERNELS

A simple aid in determining hidden insect infestation of wheat has been developed. The test, which reveals the percentage of insect-damaged wheat within a few minutes, was devised by Albert C. Apt, of the Bureau of Entomology and Plant Quarantine's Manhattan, Kansas, laboratory.

In grain sanitation determinations, the number of wheat kernels with weevil exit holes is used by the Food and Drug Administration to indicate the amount of infestation by weevils that cannot be seen with the naked eye. Mr. Apt's method is a rapid means of collecting all of the wheat kernels that have weevil holes in them.

A 100-gram sample of wheat is placed in a flat-bottomed pan 7 inches wide and 3 inches deep. A pint of a 2 per cent solution of ferric nitrate in water is poured over the wheat. The ferric nitrate causes the damaged kernels to float. The contents are swirled in the pan for 30 seconds. The weevil-damaged kernels float to the surface, and they can be lifted out of the pan onto a piece of blotting paper, where they can be counted. Since warehousemen sometime reject farm-stored grain that obviously is in bad condition, the farmer may, if he wishes, use this test on his grain beforehand, to determine the per cent of infestation.

The test is useful in connection with efforts to reduce losses due to insect infestation of stored wheat, described in the July-August 1952 issue of the Agricultural News Letter.

EDITOR'S NOTE:

Judging from the requests for reprints, one of the most popular articles which has appeared in the AGRICULTURAL NEWS LETTER was Professor Alexander Laurie's study on the keeping qualities of cut flowers. It originally was published in the March-April, 1941, issue. It is reprinted on the next four pages because of the wide interest in this subject and because we think it is still timely.

STUDIES OF THE KEEPING QUALITIES OF CUT FLOWERS

EDITOR'S NOTE: Experimental work on factors that influence the keeping qualities of cut flowers has been underway at Ohio State University for many years. Because the information developed by this research is of such widespread interest and importance, Professor Laurie, at our request, prepared the following article on this subject.

BY ALEXANDER LAURIE,
Professor of Horticulture
Ohio State University,
Columbus, Ohio.

Reprinted from March-April, 1941, Agricultural News Letter

The sporadic attempts by a number of workers to influence the keeping quality of cut flowers were based in the past largely on the reduction of bacterial decomposition of the stems submerged in water. Disinfecting chemicals and cutting of the basal portions to eliminate clogging of the conducting vessels were relied upon. Ratsek (1) showed that copper containers aided in keeping qualities, and ascribed it to the disinfecting action of copper released from the walls of the containers. Decker (2) indicated that flowers cut under water lasted longer, presumably due to the elimination of air from the conducting vessels. Hitchcock and Zimmerman (3) pointed out that low temperatures and high humidity were factors in prolonging the life of cut flowers. Thornton (4) showed that roses keep longer when stored at low temperatures with a high carbon dioxide content.

The studies at Ohio State University attempted to clarify the present conceptions, and to study not only the effect of various chemicals as disinfectants but as aids in water absorption and as agents in reducing the respiratory activities. Further studies were made to determine the place and rate of water absorption as well as the rate of respiration.

The Effect of Copper

Copper containers, copper wire, copper shavings, copper shot, and brass shot were used in the tests. The results obtained indicate that the prolongation of life of cut flowers as affected by copper varies with the type of plant used. One group included those which kept 1 to 2.7 days longer than controls. In this may be placed aster, godetia, clarkia, daffodil, stocks, snapdragons, annual chrysanthemum, calendula, nemesia, pansy, marigold, salpiglossis, and Boston yellow daisy. The second group showed no apparent difference in keeping

quality between controls and copper containers. In this group may be placed schizanthus, rudbeckia, leptosyne, myosotis, feverfew, centaurea, penstemon, and others. In only one instance has copper proven detrimental -- the carnation, in which case the length of keeping was reduced by one day. The determination of copper content showed that 1.25 ppm were present, which was found to increase to 1.6 ppm when the containers were cleaned with sulphuric acid. When copper wire and copper shavings were used the copper content increased to 2.23 ppm. This added amount showed slight increases in keeping qualities. However, for practical purposes the use of copper wire in glass containers has a distinct advantage over the copper containers.

Effect of Cutting Stems Under Water

The effect of cutting stems under water as compared with those cut in the air likewise varies with the plant used. Those which were aided by being cut under water were snapdragon, carnation, sweet pea, Boston yellow daisy, aster, annual chrysanthemum, and marigold, while calendula and stocks showed no difference in effect. Anatomical studies of the stems showed a direct correlation in this respect between stems with large conducting vessels and those with small, the former being benefited less by the under-water cutting.

Absorption of Water by Cut Flower Stems

The common belief is that flowers keep longer in deep water than in shallow, presumably based on the assumption that absorption takes place all along the stem. Tests were made with numerous replications, placing flower stems in different depths of water ranging from ½-inch to 10 inches. These tests showed that all cut flowers tried kept as well in shallow water as in deep; in many instances shallow-water treatment increased the keeping qualities by 2 to 3 days. In this group may be included snapdragon, carnation, pansy, aster, Boston yellow daisy, annual chrysanthemum, daffodil, salpiglossis, godetia, coreopsis, delphinium, cosmos, and hunnemania. The explanation of these results lies in the fact that less surface is exposed to bacterial decomposition in the water, and that absorption takes place from the base of the stem as indicated in the next series of tests.

Place and Rate of Flower Absorption

Using a mixture of 1/3 vaseline and 2/3 paraffin, the stems of various cut flowers were sealed (a) completely, (b) along the sides, and (c) the base only. Control plants were not sealed.

Table I shows that in most cases the greater portion of the water is absorbed through the cut end of the stem. The stems which were sealed along the sides absorbed more water and lasted slightly longer than those which were not sealed at all. The most probable explanation is that in the sealed sides bacterial action was reduced with attendant greater absorption and longer keeping quality.

Table I - Absorption of Water Through the Stems of Cut Flowers*

Crop	Stems Sealed Entirely		Stems Not Sealed		Base of Stem Sealed		Side of Stem Sealed		Temperature
	c.	Days	c.	Days	c.	Days	c.	Days	Degrees F.
Pansy	0	1	2.6	3	.16	1	2.5	4	65-70
Carnation	0	3	8	6	.8	3	7	6	65-70
Snapdragon	0	1	14	4	.8	1	15	4	65-70
Boston Yellow Daisy	0	1	4.3	6.7	1	5	3	6	65-70
Sweet Pea	0	1	1.3	3	.4	1	1.5	4	65-70
Cosmos	0	1	3.0	4	.13	1	4	4	75-80
Gaillardia	0	1	4.1	4	.16	1.0	4.3	4	75-80
Delphinium	0	1	21	5	.8	1	23.5	4	75-80
Larkspur	0	1	3.0	4	.9	1	7.5	5	75-80
Chrysanthemum Leucanthemum	0	1	8.6	6	1	1	10.6	6	75-80
Iris	0	1	37	7	12	3	40	7	75-80
Aster	0	1	18	8	3	2	17	8	75-80
Rose	0	1	8.0	4	1.0	1	7	4	75-80
Tritoma	0	1	33	5	1	1	42	5	75-80
Calendula	0	1	6.0	6	1	1	4	3	75-80
Hunnemania	0	1	3.0	3	3	3	3.2	3	85-100
Rudbeckia	0	1	20	4	1	1	23	4	85-100
Zinnia	0	1	50	4	1	3	54	4	85-100
Trachelium	0	1	10	4	1	1	18	4	85-100
Nasturtium	0	1	2.0	3	1	1	1.5	3.0	85-100

*Number of flowers tested was 30 to 100 for each variety.

Rate of Respiration

The rate of respiration has a bearing on the length of life of cut flowers. To determine the respiration rate, measurements of the carbon dioxide evolved were made by the carbonate precipitate method.

Table II - Rate of Respiration of Certain Cut Flowers

Crop	Number of c. of CO_2 Evolved per Hour
Aster	.0089
Boston yellow daisy	.01426
Carnation	.0285
Pansy	.3772
Snapdragon	.018

This table is but an indication of possible trends. Pansy shows the greatest amount of CO_2 given off per hour, while the aster shows the least amount. The keeping qualities of the pansy are proverbially low while those of the

aster are correspondingly long. Hence the respiratory rate seems definitely related to the longevity of the cut flower stem and is inversely proportional to the keeping rate.

Effect of Chemicals on Respiration

Tests were made in an effort to slow up the metabolism of the plant by artificially lowering the respiration rate. Materials were sought which would decrease bacterial action, increase absorption and transpiration, provide the proper hydrogen-ion concentration and osmotic pressure. Of the many materials tried, only three showed any effect on cutting down the respiratory rate: hydrazine sulfate, phloroglucinol, and resorcinol. Sodium amytol was effective on sweet peas, presumably because of its coagulative action on proteins. Further preliminary studies indicate that combinations of metallic zinc powder in proper concentrations may control the factors responsible for keeping qualities of cut flowers; namely, reduction of bacterial activity, increase of transpiration, lowering the rate of respiration, and providing the most suitable pH and osmotic pressure.

Chemical Treatment of Cut Flowers

As a result of these studies, more recent work has enabled us to suggest several formulas which may be useful in the actual keeping qualities of flowers. No. 1 and No. 4 are particularly satisfactory for roses and carnations.

No. 1. Dissolve 1 ounce hydrazine sulfate in 1 quart of water, and use this as a stock solution. To another quart of water, add 2 teaspoonfuls of the hydrazine sulfate stock solution, 2 grams manganese sulfate, and 1 tablespoonful of sugar.

No. 2. Dissolve ½ teaspoonful boric acid in 1 quart water. This is useful on carnations.

No. 3. A 10-15% sugar solution prolongs the life of China asters.

No. 4. To 1 quart water, add ½ teaspoonful of potassium aluminum sulfate (commercial alum), ½ teaspoonful sodium hypochlorite (Clorox), 1 pinch ferric oxide (iron rust), and 2 teaspoonfuls sugar. This solution is especially useful on cut roses.

Commercial products are also available.

Vitamin B, has NOT proven beneficial in prolonging the life of a wide range of flowers.

LITERATURE CITED

1. Ratsek, J. C. Tests metal containers in an attempt to increase life of cut flowers. Florists' Review, May 9, 1935.
2. Dorner, H. B. Handling cut flowers to prolong their keeping qualities. Florists' Exchange, April 28, 1934.
3. Hitchcock, A. E., and P. W. Zimmerman. Effects of chemicals, temperature, and humidity on the lasting qualities of cut flowers. Contrib. Boyce Thompson Inst. 2: No. 3. 1929.
4. Thornton, N. C. The use of carbon dioxide for prolonging the life of cut flowers with special reference to roses. Contrib. Boyce Thompson Inst. 2: No. 9. 1930.

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